DOCUMENT RESUME

ED 061 107 SE 013 622

AUTHOR	Liao, T., Ed.
TITLE	Engineering Concepts Curriculum Project Newsletter, Volume 4 Number 8.
INSTITUTION	Brooklyn Polytechnic Inst., N.Y. Engineering Concepts Curriculum Project.
PUB DATE	72
NOTE	8p.
AVAILABLE FROM	ECCP Newsletter, Polytechnic Institute of Brooklyn, 333 Jay Street, Brooklyn, New York 11201 (Free)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Attitudes; *Curriculum; *Educational Trends; Evaluation; Instruction; Newsletters; *Science Course Improvement Project; *Science Education
IDENTIFIERS	*Engineering Concepts Curriculum Project

ABSTRACT

In the major article in this issue of the "Newsletter of the Engineering Concepts Curriculum Project (ECCP)," Hurd examines the current trends in science education in the United States and lists eight priority needs for science programs in the 1970's. These priority needs are closely related to the necessity of solving science-based social problems, including intellectual skills and appropriate values. Other announcements include the results of trial administrations of ECCP attitude inventories, lists of training programs for teachers using ECCP materials, and a copy of an evaluation instrument that may be used in ECCP classrooms. The filmstrip "SIMULATION, An Educational Tool" is reviewed, and an ECCP Implementation Center at the University of South Florida is described. (AL)

The Man Made World

ECCP Newsletter

ENGINEERING CONCEPTS CURRICULUM PROJECT

VOLUME IV, NO. 8 SPRING, 1972

SCIENCE EDUCATOR CALLS FOR SCIENCE, TECHNOLOGY AND SOCIETY ORIENTATED CURRICULUM

At the general session (Nov. 19, 1971) of the School Science and Mathematics Association Convention, Professor Paul DeHart Hurd, a leading science educator from Stanford University, spoke on the direction that science teaching should take during the 1970s. His recommendations so closely reflected the philosophy and objectives of ECCP, that we invited him to publish his speech in the Newsletter. After reading Professor Hurd's paper, you will see that "The Man-Made World" course is definitely one answer to his call for "a problem-centered science curriculum especially with a man-societal context".

EMERGING PERSPECTIVES IN SCIENCE TEACHING FOR THE 1970's

At almost anytime during the 1960s a speaker on the topic of reordering priorities in science and mathematics would have summarized the rationale basic to the "new" mathematics curricula and described the goals of each of the government sponsored science programs. Much would have been said about the many efforts to improve the teaching of science and mathematics from kindergarten through college. The worthiness of these subject fields for improving the cognitive development of youth would have been stressed. And certainly one would not have overlooked the special efforts to challenge talented and gifted students.

Historical background

From a historical point of view the major thrust for the "new" curricula was provided by the blast-off of Russia's Sputnik I in 1957. Translated into educational terms science and mathematics as taught in American schools were considered inadequate to meet the demands for essential scientific and technical manpower. Schools could help alleviate this problem by up-dating and up-grading subject matter and teaching it more rigorously. Much effort was devoted to developing courses to reflect the modern theoretical structure of particular disciplines and their rational processes. The "structure of knowledge" became the model for all that was good in curriculum design and "discovery" the ideal method of teaching. The overall result was high school science and mathematics programs pleasing to specialists and researchers in colleges and universities.

In the late 1960s Americans were the first to walk on the moon, thus ending the technological crisis. What many teachers, parents and educators failed to recognize was that the era of the "new" science and the "new" math also came to an end. Some teachers were, however, more perceptive, otherwise the program committee of the *School Science and Mathematics Association* would not have chosen the "reordering of priorities" as the theme for this convention and I would not have chosen to speak on what some of these emerging perspectives appear to be.

Current trends

What follows in this talk is essentially a summary of research in progress. Although many details are omitted, hopefully there are enough to identify crucial directions in curriculum planning and the supporting rationale.

As a prologue to my comments, a brief overview of

societal events from 1965 to the present time will be helpful. It was in this period that young people began to question the American way of life and to express doubts about the "relevance" of their education. The issue to them was not how much better life is now than it used to be, but how bad society is today compared with what it could be. The values young people sought were not those typically held important by their elders, those over 30 years of age. The arguments have led to a "generation gap," a resistance toward authority of all kinds, and a desire by youth for more opportunities to direct their own lives, including the nature of their education. They have come to view contemporary society as "sick," pointing out the seemingly endless piling of crisis upon crisis: economic, political, educational, environmental, technological, and others; not to mention the tensions of everyday life, for example, war, loneliness, racism and violence.

In spite of the many efforts to improve pre-college education during the 1960s, among the best selling books in the 1970s are those which challenge the worthiness of the whole educational process including goals, the curriculum, methods of teaching and how students are evaluated. For the most part the writers are serious and base their comments upon personal experience as teachers or as critical observers of education. Possibly more important are the students' criticisms. They find courses unsuited to the modern world and foreign to their own needs as individuals. They consider instruction impersonal and unmotivating. They think tests and grades in courses are based upon the least important of objectives – the accumulation of factual information – and there is little opportunity for one to state what he has really learned.

Twenty years ago only half of the students ranging in age from 14-18 years finished high school. Today nearly 90% in this age group finish high school and half go on to college. At no time in the history of the world has education been pursued by so many people. Neither the American high schools nor colleges and universities have been able to evolve a science and mathematics curriculum sufficiently diversified to meet the range of special interests in a population sample of this size. There have been efforts to meet the problem in limited ways, such as, individualized and computer assisted instruction, audio-tutorial systems, self-directed learning, seminars and "rap sessions." For the most part these are administrative mechanisms rather than curriculum innovations, and in the long run, will likely not solve the problem.

Present status of science and technology

Let us now examine what has happened to science in the past few years. Science and technology have become closely bound together to form the basis of economic growth in developed countries. The motivation for many achievements in science has come as a response to technological needs, notably in the space program and defense research. It is interesting to note that any reference to this condition was specifically omitted by all of the nation wide curriculum studies in science and mathematics published during the 1960s.

Where do science and technology stand today? We find both are on trial: technology, which has maintained the strength of our economy for decades, is now regarded as an enemy of the natural environment and as a major force in the dehumanization of man. Scientists, who have enjoyed the isolation of the objective world for centuries, are now put upon by the general public to direct their research activities toward the common good and to add a dimension [illegible]al responsibility to the scientific enterprise. There is [illegible]-science sentiment within our culture and a fear of [illegible] technological achievements. Enrollments in science drop significantly when it is removed as a requirement for graduation, either in high school or college. While university enrollments are increasing, the number of students majoring in science and engineering are decreasing. There are writers who interpret the situation as the end of progress and a slowdown in human achievement.

I think there are several valid assumptions we can make from this background of events: (1) America of the 1970s is not the America of the 1960s; (2) the conditions of the 1970s are not a simple transition from the past, but constitute intellectual and social mutations; (3) the education of the 1960s is not appropriate for the 1970s, hence the need for new priorities; and (4) this is a new kind of world and we should not expect to find answers to current problems buried in past experiences.

Educational issues

One of the most important issues we need to consider is how to bridge the various gaps that exist between science, society, technology, and the school curriculum. We must do this at the very time society is undergoing extensive cultural transformations and much soul-searching in an effort to find itself. Quite likely the educational dilemma will not be settled by the adoption of a new orthodoxy. We tried "innovations" in the 1960s and began the 1970s by looking for "alternatives." What is required is a new vision about the kind of world we might achieve in an age of science and what the status of the individual is to be.

There have been several years of dialogue concerning these issues and what I should like to do now is identify the priorities that are shaping up. My comments will be specifically in terms of the science curriculum, although, many apply across the whole educational scene.

Priorities in science education

Science, through its technologic applications, forms a delicately balanced system that influences in a major degree our economic and political life both nationally and internationally. These conditions have advanced to the point where they can no longer be considered separated from the social forces which determine the course of human activities and our manner of living. National goals are meaningless unless the forces of science and technology can be brought to bear on the problems associated with the attainment of these goals. Under these conditions science in some form becomes a viable strand in the education of every student. This priority is based upon the assumption that a category of knowledge essential to understanding contemporary times and for planning the future course of society is a basic element of general education. This does not mean the science curriculum should be the traditional courses in biology, chemistry, physics and the earth sciences.

Throughout the science curriculum reform movement of the 1960s considerable effort was made to exclude from the new courses all references to technology and applied research. To convey a notion of the "structure of the discipline," the primary goal of these programs, it was necessary to focus the subject matter on theoretical constructs and investigative processes descriptive of a particular discipline. This is, of course, the way a "pure" researcher enjoys having his specialty displayed, but this has not proved to be an effective means for making science either interesting or meaningful for the vast majority of students. Most individuals who wish to be fully participating members of our science-based society will do so through an understanding and an appreciation of technological achievements. Science and technological activities all the way from "pure" research to invention are on a continuum within which no meaningful lines of demarcation can be shown. Over the past decade a unity of science and technology has developed in a way that makes both essential to human welfare.

Technological achievements with all their ramifications throughout modern society constitute a new priority in science and mathematics teaching; I hasten to add, however, not in the terms it was taught during the 1940s and early 1950s.

A third priority not unrelated to the previous one is the teaching of science in a social context. One cannot overlook the fact that science has become linked in various ways to nearly all aspects of man's existence. There may be a question as to whether science is the servant of society or society the handmaiden of science, but there are no doubts that each is dependent upon the other for survival. No longer ought science be taught as a subject valued for itself, independent of the rest of society, governed by its own rules and directed entirely by its own policies. The natural, social and behavioral sciences need to be brought into a relationship and presented with a consideration for the welfare of man. This will require that we take a more holistic view of the entire school curriculum than we have in the past. The problems that concern man most – disease, malnutrition, pollution, urban living, longevity, social disintegration, equality and others – are not those that can be solved within the limits of isolated disciplines.

Much of the present crisis in science and in science teaching lies in the relationship between knowledge and values. These are the questions that greatly bother young people: What are the social responsibilities of science? Does science have a commitment to humanity or only to the advancement of a discipline? Can fact and value be separated at the practical level? Scientists and sociologists alike have observed that a great deal of the conflict and turmoil we are experiencing in American life today results from a poverty of values, from too little we really care about, and from a paucity of social commitments. Is it not strange that in this period of history, when we have the knowledge and material resources to do about anything we wish, we are the most confused about what is worth doing? Values provide guidance for the use of knowledge but unfortunately we now have a science curriculum that is value-free and anti-idealistic. Science teaching is mostly concerned with matters of fact, ignoring to what end. This leads me to suggest that if science is to be meaningful for developing a higher level of human responsibility and rationality, then the opportunities for students to develop worthy values must be given high priority in science teaching. The teaching of science in a value-free context has made too many young people, as well as adults, fearful and distrustful of scientists and their endeavors.

A science curriculum, for whatever purposes it is taught, can only be justified to the non-specialist in terms of its contribution to an appreciation of human societies and the interrelatedness of man with his natural environment. It must mean something for broadening the value base and intellectual insights of students. Science teaching becomes a part of liberal education only when presented in a social context and in a manner which will affect the future of man. A priority for learning science in the 1970s is the formation of those values which may serve to convert knowledge into wisdom and make for responsible social action.

Educational programs for centuries have been planned with the idea that tomorrow will not be much different from today. The curriculum reform of the 1960s was limited to the improvement of courses only to the extent of updating subject matter and providing a better organization. Here we are in the 1970s and again faced with the task of restructuring the science curriculum. No small part of the stimulus has come from students who feel that what they are being taught is neither relevant nor useful. The issue is complex, but the message is clear; young people want an education for that period of time in which they will be spending most of their adult life. They do not want an education that has the historical setting of their parents or even that of their teachers, for they will never live in those times. Two priorities are thus suggested. One, a science curriculum ought to prepare students to cope with a world of change, and this means to achieve "maximum adaptability" in periods of cultural transition.

The other priority is related to change, but in a different sense. It is this: the process of education should do more than issue the acculturation of an individual, it should provide him with the skills and intellectual attitudes essential to understand the emerging world and to mediate the future. We are at a point in history where today is much different from yesterday and the future is spilling into the present. The entire issue of "environmental quality" and its attending problems is a good example of what I mean. It is no accident that Alvin Toffler's book *Future Shock* became a best seller; it illustrates the necessity for man to learn how to better influence his future, the only period of time in his life over which he actually has any control. Our present mode of science teaching is on a collision course with the future; the student is permitted little opportunity to free himself of the present and to consider ways in which a more satisfying future for mankind might be planned. Thus, the educational priority becomes how best to teach and learn the future, how to reach from the *here* and *now* to the *there* and *then*. In planning curricula with a future orientation we do much to shape this future.

We are moving into a period sometimes described as a "post industrial" society in which learning and knowledge are likely to be the primary economic resources of the world. However, not in the sense of a "knowledge explosion" like that of the past quarter of a century. For decades we have been content to simply add more and more knowledge to the stockpile we already have without much regard to how it will be used. Consequently, a tremendous chasm has developed between the creation of knowledge and the use of knowledge. Today we have access by one means or another to nearly all the knowledge that ever existed. Individually and collectively we know more than any other society has ever known in the past. Most of our teaching is directed to having students acquire more and more information, a startling result of all these efforts is increased ignorance. We know less about how to solve contemporary problems of life and living than in the past; witness our ecological irresponsibility, our racial prejudice, our national disunity, the disenchantment of youth with existing societal goals, the "identity crisis," to mention a few. A new educational priority is how to *use* knowledge for the welfare and advancement of mankind. The science curriculum will of necessity need to place more emphasis upon science-social problems and how what we know may be used to help resolve them.

A problem-centered science curriculum, especially within a man-societal context, is not easily organized within the framework of discrete disciplines. Human and cultural-based problems usually have roots not only in several sciences but also in non-science fields; they are multidisciplinary and transdisciplinary in character. The fragmented knowledge of discrete disciplines is too limited for interpreting human experience. A greater inter-penetration of subject matter between sciences and between the sciences and other fields of learning is needed. This is especially important if we expect the student to become a better citizen in the sense of being more informed, more concerned, and more competent to reach science-social decisions. The specialization of knowledge, which has brought us this far in the course of social evolution, is not adequate to deal with either the science or social conditions of today. There is need for a cohesiveness of knowledge and a plurality of approaches to problems. The most active fields of research in science are not in highly refined specialties but at the interface of disciplines; biology and

physics, chemistry and physics, and biochemistry. A priority for the 1970s is to develop science courses that focus upon the integration of knowledge and interrelated modes of knowing. The current practice of organizing the school curriculum into discipline bound courses inhibits students from realizing the full potential of knowledge taught in these courses.

Implied in several of my earlier comments is the notion that the teaching of research skills in the context of laboratory experiments is not adequate for solving science-based social problems. Rather, the need is for skills that help one to discover the significant questions, that allow one to pick one's way through conflicting data and that lead to rational decision making. Problems students must deal with in "real life" are more task oriented than experimental and data must be considered in qualitative as wall as quantitative terms. In coping with "real life" problems in a decision making context, (1) inquiry methods are less coercive; (2) there are usually alternative decisions that can be made; (3) the process is frequently one of determining a direction for thinking efforts; and (4) the final outcome may simply be greater insight into a problem. Decision making is more a way of maximizing the meaning of information than simply interpreting data. In comparing the inquiry procedures of the 1960s and the 1970s; in the 1960s the emphasis was upon how data are obtained, for the 1970s the priority is how data are used. In another way this is a difference between *knowledge in being* and *knowledge in action*

Here then we have a few of the educational priorities for the 1970s. Some progress has been made in translating these perspectives into specific and concrete educational practices, but we have much more to do if we are to move science teaching from "yesterday to tomorrow."

EXPERIMENTAL ATTITUDE INVENTORY

The experimental model of the E.C.C.P. Student Attitude Inventory was administered to about 150 teachers at the beginning and end of the Summer Institutes, 1971. Preliminary analysis of the data indicates some changes in the teachers' responses over the six week period.

The questionnaire was designed to gather information on changes in the students' attitudes toward science-technology-society interactions. This presents problems in that we are working at the junction of the cognitive and affective domains of learning. Because of this we have taken a middle road in that we assume that increases in the students' knowledge can change his feelings about these interactions. This compromise between a purely attitude-oriented test and its cognitive counterpart is as close as we feel that we can get with some accuracy and still use a paper and pencil test on a large group of students.

The survey was evaluated by grouping the items under three objectives: (1) Accepts the concept that science, technology and society constantly interact in many ways, (2) Agrees that matching technology to people, society and the environment must be a conscious process taking all aspects of the problem into consideration before coming to a conclusion, (3) Compares the usefulness of tools and processes for analyzing and solving problems in a technological society. The data is presented in chart and histogram form. The column labeled *Questions* is the number of questions the respondent answered in agreement with the questions we grouped under the objective concerned. *Students* is the number of students responding to a particular number of questions out of the total possible choices. *Percent* is students (teachers in this case) represented as a percentage of the total number taking the test. *Histogram* is a graphical representation of the percent column.

QUESTIONS	STUDENTS	PERCENT	HISTOGRAM	QUESTIONS	STUDENTS	PERCENT	HISTOGRAM
0	0	0.0%		0	0	0.0%	
1	0	0.0%		1	0	0.0%	
2	0	0.0%		2	0	0.0%	
3	1	0.7%		3	0	0.0%	
4	1	0.7%		4	0	0.0%	
5	1	0.7%		5	0	0.0%	
6	2	1.4%		6	2	1.3%	
7	3	2.1%	*	7	13	8.1%	**
8	8	5.6%	*	8	11	6.9%	**
9	32	22.5%	*****	9	31	19.4%	*****
10	41	28.9%	*******	10	43	26.9%	*******
11	35	24.6%	******	11	33	20.6%	*****
12	12	8.5%	**	12	20	12.5%	***
13	5	3.5%	*	13	6	3.8%	*
14	4	2.8%	*	14	1	0.6%	
15	0	0.0%		15	0	0.0%	

PRE-TEST POST-TEST

Fig. 1. Accepts the concept that science, technology and society interact...

QUESTIONS	STUDENTS	PERCENT	HISTOGRAM	QUESTIONS	STUDENTS	PERCENT	HISTOGRAM
0	0	0.0%		0	0	0.0%	
1	0	0.0%		1	0	0.0%	
2	0	0.0%		2	0	0.0%	
3	0	0.0%		3	0	0.0%	
4	0	0.0%		4	0	0.0%	
5	0	0.0%		5	0	0.0%	
6	2	1.4%		6	0	0.0%	
7	6	4.2%	*	7	4	2.5%	*
8	6	4.2%	*	8	7	4.4%	*
9	14	9.7%	**	9	8	5.0%	*
10	24	16.7%	****	10	19	11.9%	***
11	30	20.8%	*****	11	30	18.8%	*****
12	19	13.2%	***	12	40	25.0%	******
13	21	14.6%	****	13	28	17.5%	****
14	14	9.7%	**	14	16	10.0%	***
15	7	4.9%	*	15	5	3.1%	*
16	1	0.7%		16	2	1.3%	
17	0	0.0%		17	1	0.6%	
18	0	0.0%		18	0	0.0%	
19	0	0.0%		19	0	0.0%	
20	0	0.0%		20	0	0.0%	

PRE-TEST POST-TEST

Fig. 2. Agrees that matching tech. ...must be a conscious process

QUESTIONS	STUDENTS	PERCENT	HISTOGRAM	QUESTIONS	STUDENTS	PERCENT	HISTOGRAM
0	0	0.0%		0	0	0.0%	
1	0	0.0%		1	0	0.0%	
2	2	1.4%		2	0	0.0%	
3	1	0.7%		3	3	1.9%	
4	4	2.8%	*	4	3	1.9%	
5	12	8.3%	**	5	15	9.4%	**
6	29	20.1%	*****	6	27	16.9%	****
7	47	32.6%	********	7	39	24.4%	******
8	29	20.1%	*****	8	43	26.9%	*******
9	17	11.8%	***	9	28	17.5%	****
10	3	2.1%	*	10	2	1.3%	

PRE-TEST POST-TEST

Fig. 3. Compares the usefulness of tools and processes

The responses related to the first objective do not indicate any major changes (see Fig. 1). This was expected since it is assumed that the reason a teacher would commit himself for a summer is that he feels that there is value in teaching this type of course to his students.

The number of expected responses related to the second objective shows a slight increase (see Fig. 2). The mean number of expected responses increased slightly from pre- to post-test. This finding can also be explained by considering the orientation of the teacher who chose to attend a IMW summer institute.

The responses related to the third objective show a tightening of the range of responses as well as a noticeable increase in the mean number of responses (see Fig.3). This change between the pre- and post-test results shows the teachers were overcoming a weakness in their background. Specifically, the development of knowledge about and experience with various techniques of looking at systems and the associated types of learning are apparently the areas where the greatest amount of affective re-orientation is taking place.

This analysis is a pilot effort in the evolution of a reliable method of measuring and evaluating attitudinal changes. Currently, responses are being obtained from a sample group of TMMW high school students. Although the changes noticed among the teachers were too small to be significant, it is hoped that the results from the high school students will show significant changes.

POTPOURRI

INSERVICE INSTITUTES

Seven schools have been awarded NSF grants to run teacher training programs for TMMW. These institutes will take place during the 1972-73 school year. Interested secondary teachers should use the following table and contact the director of each institute for information and application blank.

Location		Director
University of Colorado Colorado Springs	80907	J. Sherman
University of Illinois Chicago Circle	60680	H. Setton
University of Wisconsin Green Bay	54305	J. Busch
University of Pennsylvania Philadelphia	19104	K. George
Reed College Portland	97202	K. Davis
Wichita State University Wichita	67208	M. Tilford
University of California Berkeley	94702	J. Whinnery

SIMULATION – AN EDUCATIONAL TOOL

Professor Ludwig Braun, author of the technical note in the past issue of the Newsletter, has been directing one of the most innovative programs (Huntington Two-H2) for using digital computer simulation as an educational tool for high school students. The H2 staff has recently developed a cassette/filmstrip package to introduce educators to their program. We are reprinting their announcement because many TMMW teachers have also been using digital computers in the simulation mode and would be interested in any new approaches in the area of educational technology.

"In response to numerous requests for information from many different sources concerning the work of the HUNTINGTON TWO Project and the use of computer-based simulations in the high-school classroom, the H2 staff has produced a 16mm color filmstrip to explain the nature of simulation and its rationale, as well as to explore the use and implementation of simulations in the classroom.

In *SIMULATION, An Educational Tool* we have attempted to answer, as specifically and thoroughly as possible, the most commonly asked questions about the use of computer simulations in the classroom, and to lay at rest the fears of those who are contemplating their use for the first time.

The filmstrip comes in two parts, with sound furnished by a cassette tape; the whole filmstrip runs approximately 1 hour. Much of the information is related in a discussion between H2 staff members, three of our Project consultants who are high school teachers, and three high school teachers who have only recently been introduced to simulations, but who are interested in using them in their classrooms. The discussion is illustrated with many shots of teachers and students as they participate in simulation, whether in the biology, social studies or physics classroom, and there is one long segment on the efforts of three students to develop an effective health program, given limited funds, for the control of malaria in a tropical country. Many points are made through references to specific programs that have been developed or that are currently under development by the H2 staff.

The Project has on hand 20 copies of the filmstrip which we are eager to lend out – first to the participating schools, and then on a first come-first served basis to other interested parties. There is no charge to borrow the film and different dates and loan periods can be arranged. To request a loan, just write: Mrs. Mary Wild, Polytechnic Institute, 333 Jay Street, Brooklyn, New York 11201."

ACTIVITIES OF DENVER UNIV. IMPLEMENTATION CENTER

1. Continuing Group Support for Existing Teams
   April 13-14, 1972 *(20 Participants from Western U.S.)*
   a. Development of skills in micro-design of specific learning activities for teachers.
   b. Proposal writing skills for CCSS and others.

   September 14-15, 1972 *(20 Participants from Western U.S.)*
   a. Continuation of micro-design skills development.
   b. Development of sample Information Awareness Conference for College Faculty from Teacher Education Institutions.
2. Impact on Pre-Service Program and Identification of College Leadership
   March 14-16, 1973 *(30 Participants from Colleges of Education in the Western U.S.)*
   a. Power of the Curriculum Organizers in ECCP
   b. AAAS Guidelines and ECCP
   c. Linking teacher change agents with college faculty.
3. Consultant Services for Existing Teams and New Areas
   (D. U. staff will be available for consulting in areas of the Western U.S.)

TMMW MATERIALS USED IN ST. LOUIS PROGRAM

A program to acquaint inner-city high school students and their parents with technology, its implications, opportunities and uses was presented on four Saturdays in May, 1971.

This program was a cooperative undertaking of University of Missouri-Rolla Graduate Engineering Center in St. Louis, University of Missouri Extension Center of St. Louis County, The Institute of Electrical and Electronics Engineers, and Florissant Valley Community College, Electrical Engineering Division.

The program operated on the TMMW premise that:

(1) Learning should be fun.
(2) Subject matter must be relevant.
(3) Science should be easy.

The instructors from the Rolla Graduate Engineering Center, Dr. Herbert A. Crosby and Dr. John A. Newell, did an absolutely fabulous job relating to, communicating with and teaching the clientele group of inner-city youth. Their preparation, enthusiasm, and skill in teaching are credits to the University of Missouri. They were aided by Dr. Thomas Liao, Associate Director of ECCP in the planning of the program.

The instructors led the group from simple demonstrations to more complex ideas understanding the basic components and opportunities of computers. With this automation man may be relieved from routine decision making in important areas of economics, politics, and social problems.

ie students through the work of ... and
Pic. High School Guidance Counselors and YMCA also
iited students. The outreach program of the YMCA
ided shuttle bus service to the college.
he program was encouraging to us, the instructors and
sors, and was an excellent pilot undertaking. Experi-
gathered will be most useful in future programs. It is
ned to offer the program again, this year to a larger
p.

NEW FEEDBACK INSTRUMENT

he feedback package for TMMW provides the teacher paper and pencil test items at the end of each chapter, dardized tests which contain both multiple choice test s and essay questions, and the accompanying Observa- Check Lists.

ince much of the course is activity-centered, and many ne objectives are behavioral in nature, it is difficult to sure student achievement of these objectives through use of paper and pencil tests, or by reading student ratory notes and homework papers. It is really neces- to *observe* behavioral changes.

he Observation Check Lists have been developed for purpose of recording observations of student perfor- ce during laboratory periods and discussion sessions ure game, student led discussions, etc.).

is hoped that each teacher will develop his own system using the Check List as he becomes more experienced it. The following suggestions were developed by a ed number of teachers experienced with TMMW. It is mmended that these suggestions be followed for the od of time covered by at least one Check List.

he Observation Check List is a set of observable be- oral objectives possibly met by students during the time are studying TMMW. It is not expected that every ent would be observed in the performance of each ctive. It is also not expected that every student will n every objective at the same level. *Observation by the her* during laboratory activity sessions, group discus- s and private conferences should provide the basis for rmining whether the student has achieved a specific ctive, and at what level.

n the case of Robert Adams, the numbers and dates in boxes formed by his name and the objectives indicate on September 28th he was observed by the teacher bably in lab). In the teacher's opinion, Robert met the ctives of constructing a graph from student collected by following the directions given in the laboratory uctions (or by the teacher or some student). On Oct. , Robert constructed graphs from student collected by using his own initiative in reformulating the instruc-

1. Imitates, recalls, follows instructions. 2. Interprets, predicts, discriminates. 3. Creates, forms new ideas and approaches. 0. Did not attain the objective.	Construct a graph from student collected data	Model a linear equation with two or more variables on the Analog Computer	Discriminate between models with appropriate details as compared to irrelevant details
Robert Adams	1. 9/28 2. 10/16	0. 12/10 1. 12/12	
Edmund Anderson			3. 12/18

tions, and made justifiable predictions from the graph. On December 10th, he was attempting to model linear equations on the analog computer but could not accomplish this even with specific instructions. On December 12th, he was able to master this technique by following the instructions.

While it is not expected that each student would be checked for each objective, obviously the more checks that can be made the more data will be available for *your* evaluation of *your* progress *in helping students meet these behavioral goals.*

In the case of Edmund Anderson, notice that the third objective was achieved on December 18th. This could have been observed during a lab, during a class discussion, or during a personal interview. Since it is at the third level it indicates that Ed was creative in his discrimination and probably came up with a model which was not readily available in the text or from the teacher or other students.

The blank space for Robert Adams indicates that prior to December 18th, the teacher did not observe Robert attempting to attain that objective.

The above procedure provides the teacher an opportunity to record his observation of student progress so that he might better assist the student in attaining certain course objectives. *It is not meant to be the basis of student grades.*

Reproduced on the next page are six check lists which a teacher can use to monitor student progress in various portions of the TMMW text. Due to the large number of measurable behavioral objectives from chapters 12-15, two check lists are presented for this portion of the course. Both the performance levels and behavioral objects are presented in abbreviated form to save space. Interested teachers can receive more complete statements by writing to ECCP headquarters.

TMMW OBSERVATION CHECK LISTS

DURING THE STUDY OF CHAPTERS 1-3 OF TMMW the student named was able to:

Performance Levels	Communicate information graphically	Graph student collected data	Describe all factors important to timing traffic lights	Choose systematic rather than "Common Sense" attacks on problems	Construct non-linear graphs as 1 technique of optimization	Accept a variety of problem solving methods	Predict outcome of efforts to improve service using queuing theory	Develop and use simple algorithms in zero-sum games	Use game theory to influence favorable outcome in non zero-sum games
1. Imitates, recalls, follows instructions. 2. Interprets, predicts, discriminates. 3. Creates, forms new ideas & approaches. 0. Did not attain the objective.									

DURING THE STUDY OF CHAPTERS 4-6 OF TMMW the student named was able to:

Performance Levels	Contrast functional and descriptive models	Test model against real world	Model linear equation on analog computer	Move from block diagram model to analog computer	Simulate a system on analog computer	Demonstrate use of cro in sound study	Construct and manipulate sinusoid on analog computer	Discriminate between model with appropriate vs. irrelevant data
1. Imitates, recalls, follows instructions. 2. Interprets, predicts, discriminates. 3. Creates, forms new ideas & approaches. 0. Did not attain the objective.								

DURING THE STUDY OF CHAPTERS 7-9 OF TMMW the student named was able to:

Performance Levels	Manipulate model components of real feedback system	Demonstrate goal seeking vs self regulating aspects of feedback	Demonstrate intermittent vs continuous feedback	Use positive feedback to create instability in a system	State useful & destructive effects of oscillation	Use a model to identify business strategies leading to instability	Simulate how physical systems become unstable	Simulate how human reaction time delay affects control of complex problems	Show effect of design in modeling machines to men
1. Imitates, recalls, follows instructions. 2. Interprets, predicts, discriminates. 3. Creates, forms new ideas and approaches. 0. Did not attain the objective.									

DURING THE STUDY OF CHAPTERS 10-11 AND USING CARDIAC THE STUDENT named was able to:

Performance Levels	Demonstrate basic operation cycle of a stored program computer	a) Develop machine language program from flow chart, and b) follow program	Locate a loop in program	Operate a shifting program	Write a program to test accumulator	Translate and test program from English to machine code
1. Imitates, recalls, follows instructions. 2. Interprets, predicts, discriminates. 3. Creates, forms new ideas and approaches. 0. Did not attain the objective.						

DURING THE STUDY OF CHAPTERS 12-15 OF TMMW THE STUDENT named was able to design and wire:

Performance Levels	Simple on-off logic circuit	"And" circuit and "or" circuit	Compound logic circuit from combinations of simple circuits	Logic circuits to simulate real situations	Logic circuits involving three or more inputs	A "tree" circuit for a specific problem	A simple memory circuit	A four cell memory circuit
1. Imitates, recalls, follows instructions. 2. Interprets, predicts, discriminates. 3. Creates, forms new ideas and approaches. 0. Did not attain the objective.								

DURING THE STUDY OF CHAPTERS 12-15 OF TMMW THE STUDENT WAS ABLE TO:

Performance Levels	Demonstrate operation of a relay	Demonstrate use of a relay as a switch	Construct a binary adder on LCB	Demonstrate use of a "tree circuit"	Construct a comparison circuit for two 2-digit numbers	Demonstrate operation of a shift register	Construct a circuit which transfers information	Demonstrate operation of a digital computer made from LCBs
1. Imitates, recalls, follows instructions. 2. Interprets, predicts, discriminates. 3. Creates, forms new ideas and approaches. 0. Did not attain the objective.								

IMPLEMENTATION CENTER AT UNIVERSITY OF SOUTH FLORIDA

The College of Engineering, having continued support from the National Science Foundation is serving a growing community of interest in ECCP in Florida as well as providing information and assistance to neighboring gulf coast states.

This year an expansion is taking place as the Center moves forward on two fronts. First is a continuation of the academic year effort directed primarily toward information, assistance and organization. Second is a summer effort directed toward increasing the multiplication factor of training the teachers of teachers. The nucleus for this endeavor are the Director of the Implementation Center, Dean E. W. Kopp of the College of Engineering; Dr. L. E. Monley for the College of Education, Associate Director; Dr. George J. Cowell, Coordinator of Special Programs; Mr. Henry Fraze, ECCP Coordinator and Mrs. Margaret Mossey, secretary of the Implementation Center. A closer look at the mission of the center during the year will clarify its activities.

During the academic year the center will continue its previous activities of service to the gulf coast area. These activities include:

1. Work with school administrators, teachers and officials of state, county and private systems to provide insight into The Man Made World.

2. Assist county school systems in the development of ECCP In-Service Training Programs.

3. Encourage and work with colleges and universities on the incorporation of ECCP material in teacher education programs.

4. Provide consultation to teachers offering TMMW for the first time and who may not have had access to other follow-up programs.

5. Assist with equipment problems and in the development of local resources for long range service.

6. Development of an ECCP film library for teachers of TMMW.

7. Development of lasting programs in TMMW.

In the summer effort the ground work will be laid for the establishment of local (satellite) centers to provide information, training and service for ECCP in their areas. Our belief is that unless the subject content of the MMW can be introduced into the programs and curricula of the institutions involved in teacher training, then the project itself will have limited impact over the long term.

This summer we will offer a four week summer institute directed specifically at the problem of integrating the subject material of TMMW as part of the course work offering of institutions involved in teacher training. The plan provides for eight institutions to participate in the program. The team from each cooperating institution would consist of three people, one faculty member from the College of Education, one faculty member from either engineering or science and one high school teacher from the immediate geographic area of the participating institution. It is the intent of this arrangement to provide the institution with experienced people to initiate the course work, as well as a high school in the immediate area actively interested in the program.

This summer will also include a CCSS project between 25 high school teachers and the College of Engineering. This project will stress a multi-disciplinary team approach which TMMW fits into so well.

The University of South Florida has approval to initiate a variation of the ECCP as a general education requirement for its students and is beginning discussions with other universities and junior colleges for a similar arrangement. Preliminary clearance has paved the way for a cooperative proposal from the College of Engineering and the College of Education for the initiation of a science education Master's degree program having a strong background in the ECCP material.

It's an exciting and interesting time with ECCP in the Florida area. Anyone in the gulf coast area of the southeastern United States is invited to write for more information to the center.

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63623

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